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REMARKS/ARGUMENTS**1.) Claim Amendments**

Claims 15, 35-37, 40-46, 50, and 53-68 are pending in the application. Claims 1-14, 16-34, 48, and 49 were previously canceled, and claims 38, 39, 47, 51, and 52 have been canceled herein. Claims 61-68 have been added herein. Claims 35-37, 40-46, 50, 56, 57, and 60 have been amended to distinguish them from the cited references. Favorable reconsideration of the application is respectfully requested in view of the foregoing amendments and the following remarks.

2.) Allowable Subject Matter

The Applicants gratefully acknowledge the allowance of claims 15 and 45. Claim 45 depended from rejected base claim 35, and has been rewritten in independent form to include the limitations of base claim 35. Therefore, the allowance of amended claim 45 is respectfully requested.

3.) Claim Rejections – 35 U.S.C. § 103(a)

In paragraphs 2-3 of the Office Action, the Examiner rejected claims 35-40, 42-44, 46-47, 50-54, 56-58 and 60 under 35 U.S.C. § 103(a) as being unpatentable over the applicants admitted prior art (AAPA) in view of Ramakrishnan (US 5,974,028). Claims 38, 39, 47, 51, and 52 have been canceled. The Applicants have amended the remaining claims to distinguish the claimed invention from AAPA and Ramakrishnan. Reconsideration of the pending claims is respectfully requested.

Two key features recited in claim 35 (and independent claims 50, 56, 57, and 60) are not taught or suggested by AAPA or Ramakrishnan. These features are:

(1) a determining means in the sender for determining from the received acknowledgement data unit, whether the correctly received data unit was the initial data unit or the retransmitted data unit; and

(2) an excessive delay response mechanism for transmitting subsequent data units in accordance with an excessive delay response procedure, in response to a

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determination that the correctly received data unit was the initial data unit, wherein the congestion window parameter is increased to compensate at least partially for any reduction of the congestion window parameter made in response to detecting the apparent failure of the receiver to receive the initial data unit.

The Applicants appreciate the Examiner taking the time to conduct the telephone interview on April 13, 2004, and also appreciate the fact that the Examiner consulted with other Examiners prior to issuing the current Office Action. However, the Applicants feel that the arguments put forth by the Examiner still reflect a basic misunderstanding of the claimed invention in relation to the prior art. In particular, the Applicants object to the following three arguments formulated by the Examiner:

- (1) AAPA/Ramakrishnan teach an "an excessive delay response procedure";
- (2) Ramakrishnan teaches an "a determining means"; and
- (3) "Packet loss" is equivalent to "excessively delayed packet".

Regarding argument (1), the Examiner stated that the excessive delay response procedure is shown by the congestion window on page 4, line 16 of AAPA and in col. 7, lines 8+ of Ramakrishnan. The Applicants respectfully disagree.

The Applicants have defined the term 'excessive delay response procedure' in several places in the specification. For example, on page 7, lines 26-33, the specification states:

"Consequently, the response procedure to excessive delay [...] comprise keeping the transmission rate at the previous level, but on the other hand increasing the time-out period, [...]"

Page 10, line 34 - page 11, line 12 states:

"On the contrary, [...] response procedure is run that answers an excessive delay. [...] this may consist in returning the congestion window to the value stored in step S2 and on the other hand adapting the time-out period to the delay. [...]"

Page 14, line 31 - page 15, line 8 states:

"More specifically, [...] the sender will perform an appropriate response procedure to the excessive delay, namely not retransmit the data units following the first

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retransmitted data unit, and also not decrease the transmission rate, much rather the sender will increase the time-out period [...]"

In summary, the excessive delay response procedure as defined above does at least one of the following: (1) it increases the congestion window towards a stored previous value of the congestion window, (2) it increases a time-out period, and (3) it avoids retransmitting data units that have already been transmitted. Independent claims 35, 50, 56, 57, and 60 have been amended to recite that the excessive delay response procedure increases the congestion window parameter to compensate at least partially for any reduction of the congestion window parameter made in response to detecting the apparent failure of the receiver to receive the initial data unit. The Applicants contend that an excessive delay response procedure or mechanism that increases the congestion window parameter under these circumstances is not taught or suggested by AAPA or Ramakrishnan.

Regarding argument (2), the Examiner stated on page 3 of the Office Action that Ramakrishnan teaches a determining means for determining from the acknowledgements whether the correctly received data unit was the initial data unit, or a retransmitted data unit. The Examiner refers to Ramakrishnan, col. 5, lines 45-55.

However, the Applicants contend that Ramakrishnan's means will only work in special cases, but it will not work in general. In particular, Ramakrishnan's means will not work in case of an excessively delayed packet as shown in the following two figures. Note that addressing the case of excessively delayed packets is the object of the Applicants' claimed invention.

A special case where Ramakrishnan's means does work is given in Ramakrishnan, FIGS. 2B and 2C. In FIG. 2B, the sender 10 concludes from the received SACK that packet no. 7 has been received by the receiver 40, but that it has been received with bit errors. Consequently, the sender retransmits packet no. 7 (see FIG. 2C). When the corresponding SACK returns to the sender indicating that packet no. 7 has been correctly received, the sender can conclude from that SACK that the correctly received packet no. 7 was the retransmission of packet no. 7. This conclusion

can be made because it has already been reported that the initially transmitted packet was received with errors.

A case where Ramakrishnan's means does *not* work is depicted in FIG. 1 below, which shows packet re-ordering in TCP due to the excessive delay of a packet. Note that the square symbols stand for data packets, and the diamonds stand for acknowledgements. The square symbols carry the packet numbers while the diamonds (acknowledgments) carry the packet number of the next packet expected by the TCP receiver. For example, a diamond symbol that carries a packet number 4 indicates that the TCP receiver has received packet number 3 and all earlier sent packets, and that the TCP receiver is now waiting for packet number 4.

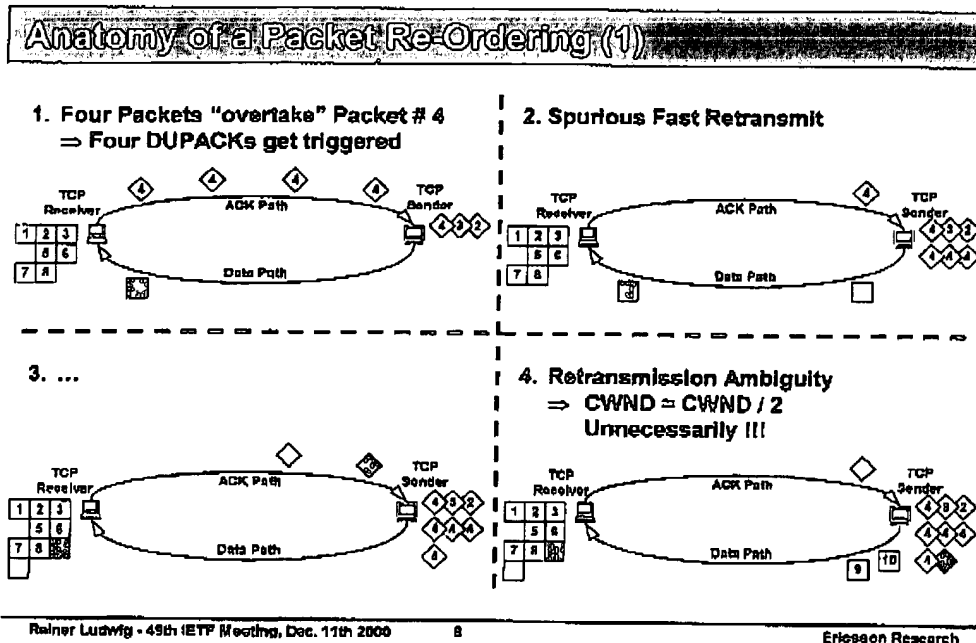


FIG. 1

The first quadrant of FIG. 1 shows a packet re-ordering event where packets 5-8 have "overtaken" packet no. 4. In other words, packet no. 4 has been excessively delayed, because it has been delayed long enough for packets 5-8 to "overtake" it and be received by the TCP receiver before packet no. 4 arrives. For each of the packets 5-8, the TCP receiver generates a duplicate acknowledgement (carrying no. 4). Upon receiving the 3rd duplicate acknowledgement, the TCP sender unnecessarily retransmits packet no. 4 (shown in quadrant 2) and unnecessarily reduces its

congestion window. That is, the excessive delay of packet no. 4 has unnecessarily triggered TCP's fast retransmit and fast recovery algorithms. Thus, packet re-ordering is a special case of excessive delay. As a result, TCP's performance is reduced unnecessarily due to an excessively delayed packet.

Thereafter (shown in quadrant 3), the initial transmission of packet no. 4 arrives at the TCP receiver triggering an acknowledgement no. 9, the packet number of the next packet expected by the TCP receiver. When this acknowledgement arrives at the TCP sender, the TCP sender has no way of telling from that acknowledgement whether the correctly received packet no. 4 was the initial transmission of packet no. 4 or the retransmitted packet no. 4.

Ramakrishnan does not solve this problem because (1) Ramakrishnan does not teach or suggest determining means for determining from the acknowledgements whether the correctly received data unit was an initial data unit or a retransmitted data unit; and (2) Ramakrishnan does not teach or suggest an excessive delay response procedure that increases the congestion window parameter as described above and recited in amended claim 35.

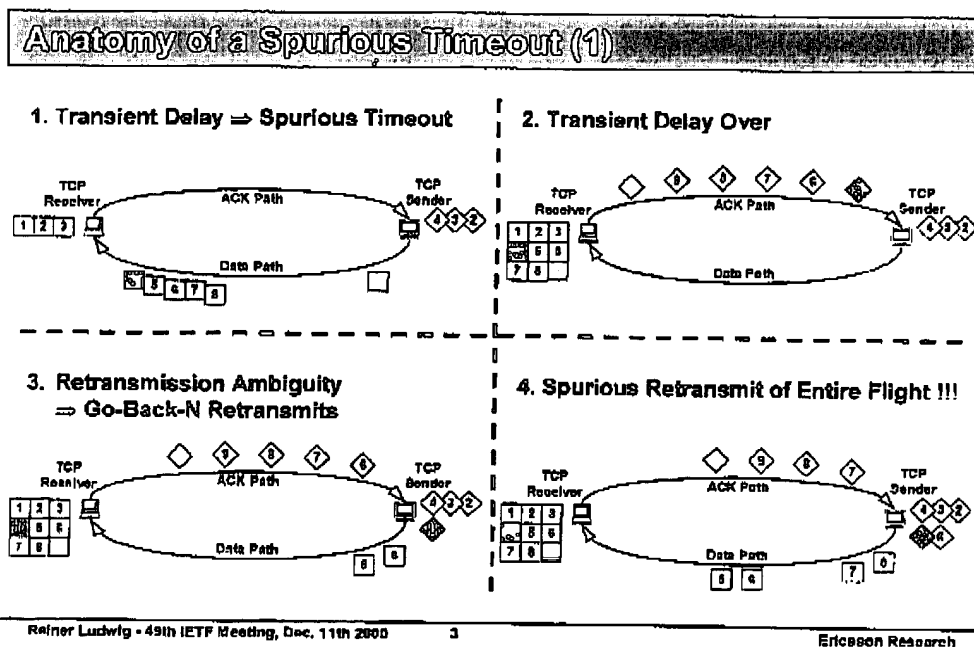


FIG. 2

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A similar example for which Ramakrishnan does not work can be constructed without reordering, but where a packet is so excessively delayed in the network that the TCP sender's retransmission timer expires. This is shown in FIG. 2 above.

As shown in quadrant 1, the excessive delay of the initial transmission of packets no. 4-8 causes the sender to retransmit packet no. 4. When the initial packet no. 4 arrives at the TCP receiver, an acknowledgement no. 5 is triggered. When this acknowledgement arrives at the TCP sender (shown in quadrant 2), the TCP sender again has no way of telling from that acknowledgement whether the correctly received packet no. 4 was the initial packet, or the retransmitted packet no. 4. As a result (shown in quadrants 3-4), the TCP sender unnecessarily retransmits all packets 5-8, and unnecessarily triggers TCP's slow start algorithm. As a result, TCP's performance is reduced unnecessarily due to an excessively delayed packet.

Once again, Ramakrishnan does not solve this problem because (1) Ramakrishnan does not teach or suggest determining means for determining from the acknowledgements whether the correctly received data unit was the initial data unit or a retransmitted data unit; and (2) Ramakrishnan does not teach or suggest an excessive delay response procedure that increases the congestion window parameter as described above and recited in amended claim 35.

Regarding argument (3), the Examiner stated that he and other examiners determined that "packet loss" is equivalent to an "excessively delayed packet". In state-of-the-art reliable protocols (e.g., TCP), it is true that a packet loss is treated equivalent to a packet that has been excessively delayed. *However, this is the very problem the Applicants' claimed invention is solving.* Treating both events as being equivalent may lead to serious protocol performance problems. For the case of TCP, the resulting performance problems have been described in detail with respect to FIG. 3 in the Applicants' specification starting on page 11, and have been exemplified in the discussion above.

In fact, it is the object of this invention to solve the performance problems caused by treating excessively delayed packets as being lost, and the key features of the

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invented solution are (1) the mentioned determining means to discriminate between a 'packet loss' and an 'excessively delayed packet', and (2) the mentioned excessive delay response procedure, which is different from the lost packet procedure.

It should also be noted that in the context of TCP, an 'excessively delayed packet' can mean two things: (1) as shown in FIG. 1 above, it can mean a packet has been reordered by more than 3 packets leading to an unnecessary retransmission and the unnecessary triggering of TCP's fast retransmit and fast recovery algorithms; or (2) as shown in FIG. 2 above, it can mean a packet has been so excessively delayed in the network that the TCP sender's retransmission timer expires leading to an unnecessary retransmission of all previously sent but not yet acknowledged packets, and an unnecessary triggering of TCP's slow start algorithm. In both cases, TCP's performance is reduced unnecessarily. These two situations were described starting on page 11 of the original specification, with respect to FIG. 3. The claimed invention solves these problems, and the solution is not taught or suggested by AAPA or Ramakrishnan.

The Applicants' use of the term 'excessively delayed packet' is described in the specification with respect to FIG. 1 (see page 10, line 25 - page 11, line 2). It is also there where an 'excessively delayed packet' is distinguished from a lost packet: "[...] because step S5 indicated that in fact the original transmission of the data unit was not lost, but only excessively delayed, [...]".

Note that for TCP, both a packet re-ordering event (see FIG. 1 above), and a transient delay (see FIG. 2 above), will cause the claimed invention to transition from step S5 (the mentioned determining means) to step S6 (the mentioned excessive delay response procedure) in FIG. 1 of Applicants' specification. Hence, both events are treated as examples of an excessively delayed packet.

Independent claims 35, 50, 56, 57, and 60 have all been amended to recite that the excessive delay response procedure (or mechanism) increases the congestion window to compensate at least partially for any reduction of the congestion window parameter made in response to detecting the apparent failure of the receiver to receive the initial data unit. The Applicants contend that an excessive delay response

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procedure or mechanism that performs in this manner is not taught or suggested by AAPA or Ramakrishnan. Therefore, the withdrawal of the rejection under § 103 and the allowance of independent claims 35, 50, 56, 57, and 60 are respectfully requested.

Claims 36, 37, 40, 42-44, 46, 47, 53, 54, 58, and 59 depend from base claims 35, 50, and 57 and recite further limitations in combination with the novel and unobvious elements of the base claims. Therefore, the allowance of claims 36, 37, 40, 42-44, 46, 47, 53, 54, 58, and 59 is respectfully requested.

In paragraph 4 of the Office Action, the Examiner rejected claims 41, 55, and 59 under 35 U.S.C. § 103(a) as being unpatentable over the applicants admitted prior art (AAPA) in view of Ramakrishnan, and further in view of Burdick et al. (US 6,041,352). However claims 41, 55, and 59 depend from base claims 35, 50, and 57, respectively, and recite further limitations in combination with the novel and unobvious elements of the base claims. The Applicants contends that the amendments to the base claims are not taught or suggested by Burdick or the combination of Burdick with AAPA and Ramakrishnan. Therefore, the allowance of claims 41, 55, and 59 is respectfully requested.

4.) New Claims

New claim 61 is similar to allowed claims 15 and 45 except that a comparison of timestamps is used to determine whether the received acknowledgment data unit is associated with an initial data unit or the retransmitted data unit. The Applicants contend that claim 61 is allowable in view of the cited references. The Examiner cited Burdick for the use of timestamps in the flow control. However, the combination of AAPA, Ramakrishnan, and Burdick does not teach or suggest each element of claim 61. In particular, none of the cited references teach or suggest a system or method in which the sender determines whether a received acknowledgment data unit is associated with an initial data unit or a retransmitted data unit, and performs an excessive delay response procedure upon determining that the received acknowledgment data unit is associated with an initial data unit.

Claim 61 recites that the sender transmits initial data units to the receiver and places a timestamp in each of the data units when each data unit is transmitted. When

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the sender detects a failure of the receiver to receive at least one initial data unit, the sender retransmits the at least one data unit that the receiver failed to receive, places a timestamp in the retransmitted data unit, and stores the timestamp of the retransmitted data unit in the sender. Thereafter, the sender receives an acceptable acknowledgment data unit indicating that the receiver correctly received one of the data units. The sender then determines whether the received acknowledgment data unit is associated with an initial data unit or the retransmitted data unit. This is done by comparing the timestamp received in the acknowledgment data unit with the stored timestamp of the retransmitted data unit; determining that the received acknowledgment data unit is associated with the retransmitted data unit if the timestamp received in the acknowledgment data unit matches the stored timestamp of the retransmitted data unit; and determining that the received acknowledgment data unit is associated with an initial data unit if the timestamp received in the acknowledgment data unit is smaller than the stored timestamp of the retransmitted data unit.

A method in which the sender determines whether the received acknowledgment data unit is associated with the initial data unit or its retransmission in this manner is not taught or suggested by the cited references. Basis for new claim 61 is found in the specification on page 16, last four lines, and page 14, second and third full paragraphs. Therefore, the allowance of new claim 61 is respectfully requested.

Claims 62-68 depend selectively from base claims 35, 50, and 60 and recite further limitations in combination with the novel and unobvious elements of claims 35, 50, and 60. Therefore, the allowance of claims 62-68 is respectfully requested.

CONCLUSION

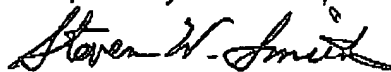
In view of the foregoing amendments and remarks, the Applicants believe all of the claims currently pending in the Application to be in a condition for allowance. The Applicants, therefore, respectfully request that the Examiner withdraw all rejections and issue a Notice of Allowance for claims 15, 35-46, and 50-68.

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The Applicants request a telephonic interview if the Examiner has any questions or requires any additional information that would further or expedite the prosecution of the Application.

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